



US Army Corps
of Engineers®
Portland District

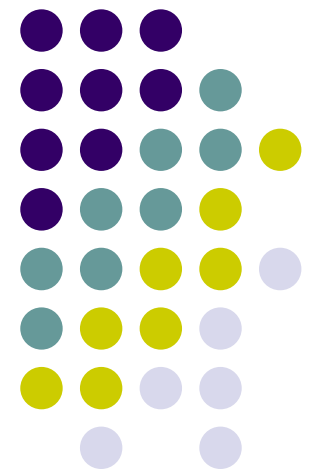
Monitoring & maintaining coastal structures at NWP

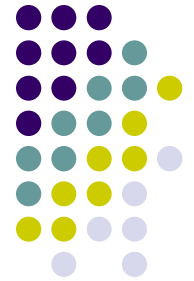


USACE Coastal CoP meeting

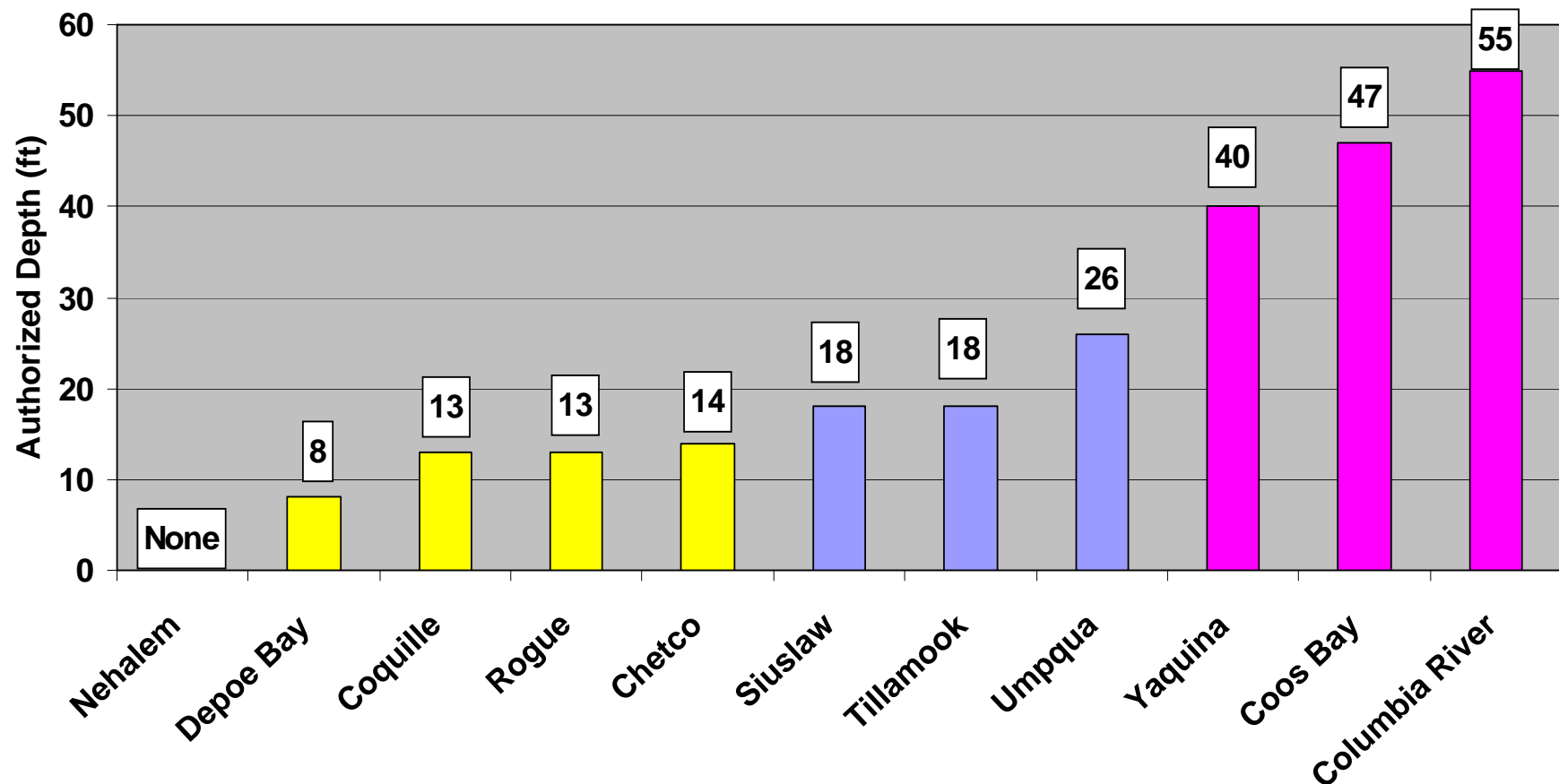
17 May 2006

David R. Michalsen





Authorized channel depths (entrance)



While > 50% would be classified as “deep” draft by Corps guidelines, majority fall into small port classification in terms of vessel usage and economic output.

Structure Inspections & Monitoring

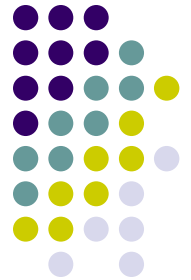


Fig. Components of damage & triggers for significance of damage

Coos Bay North Jetty Breach and Emergency Repair



**November 8, 2002
North Jetty Breach**

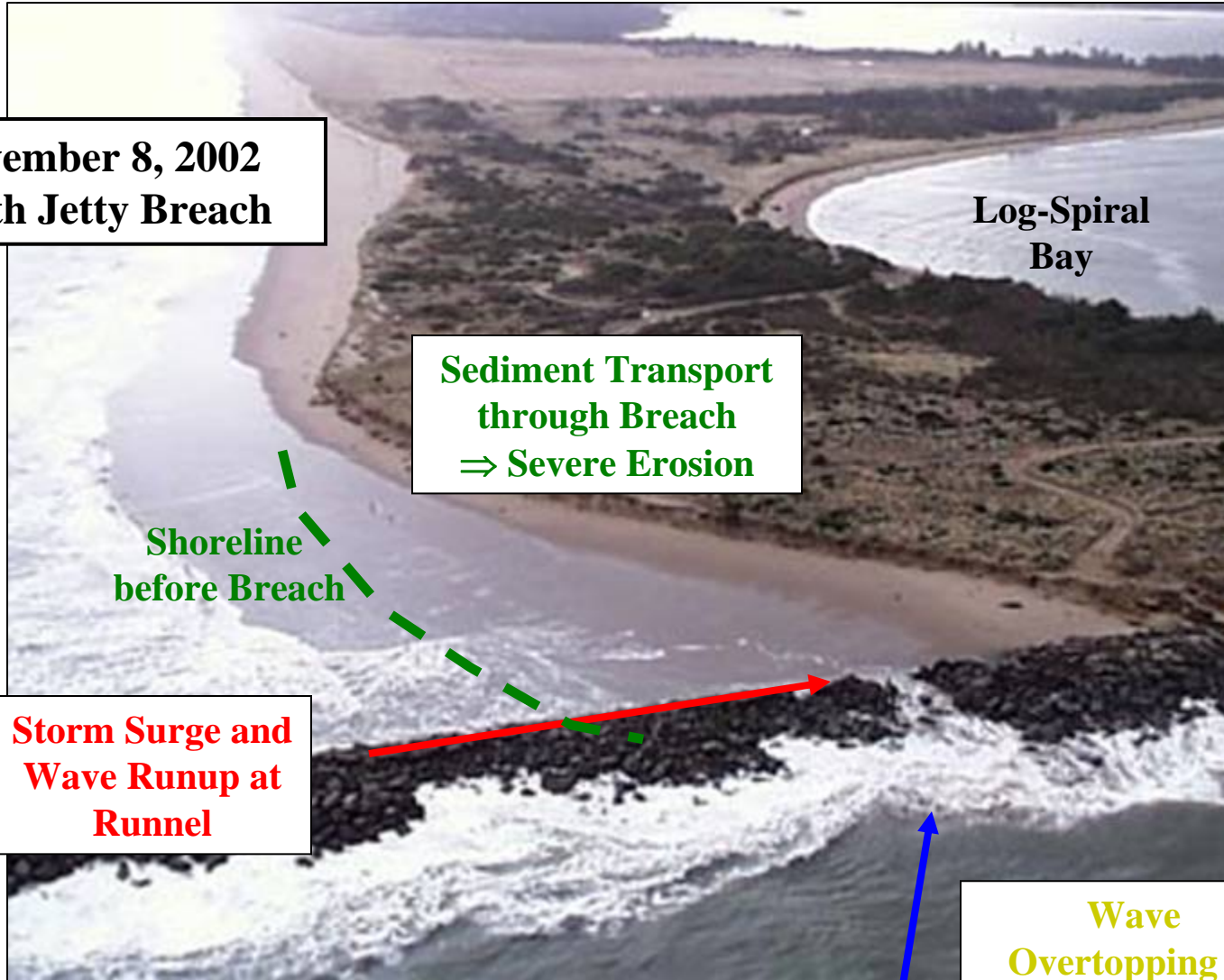
**Log-Spiral
Bay**

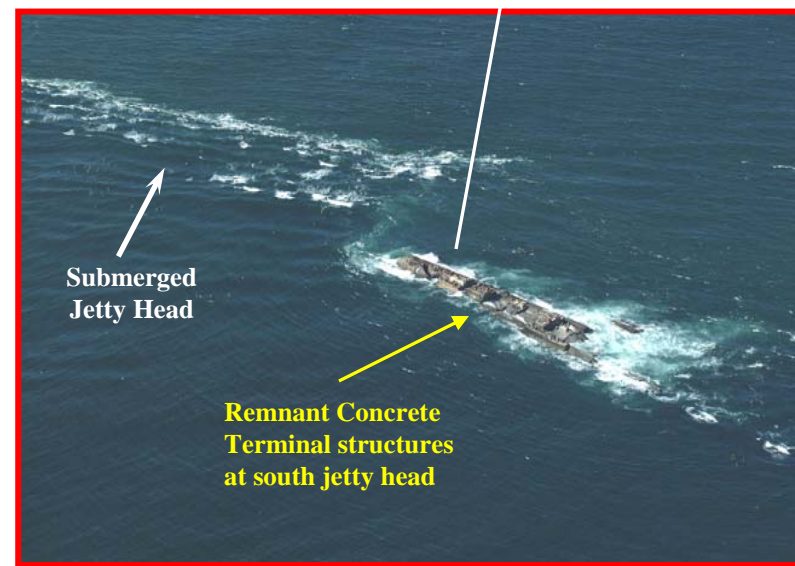
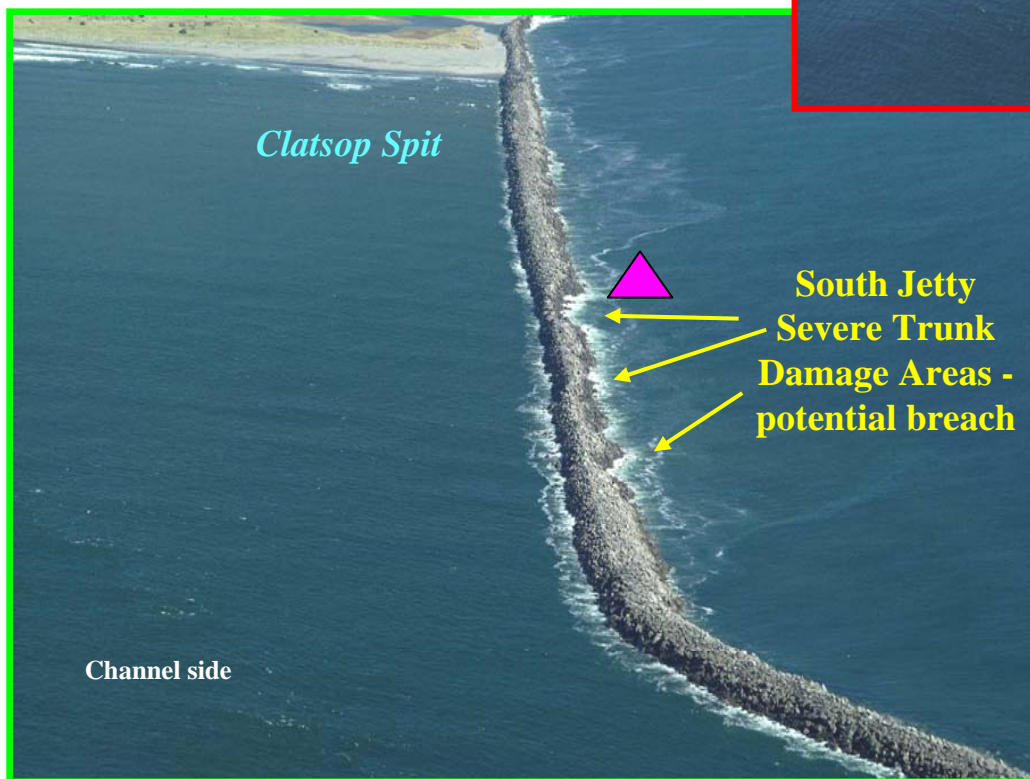
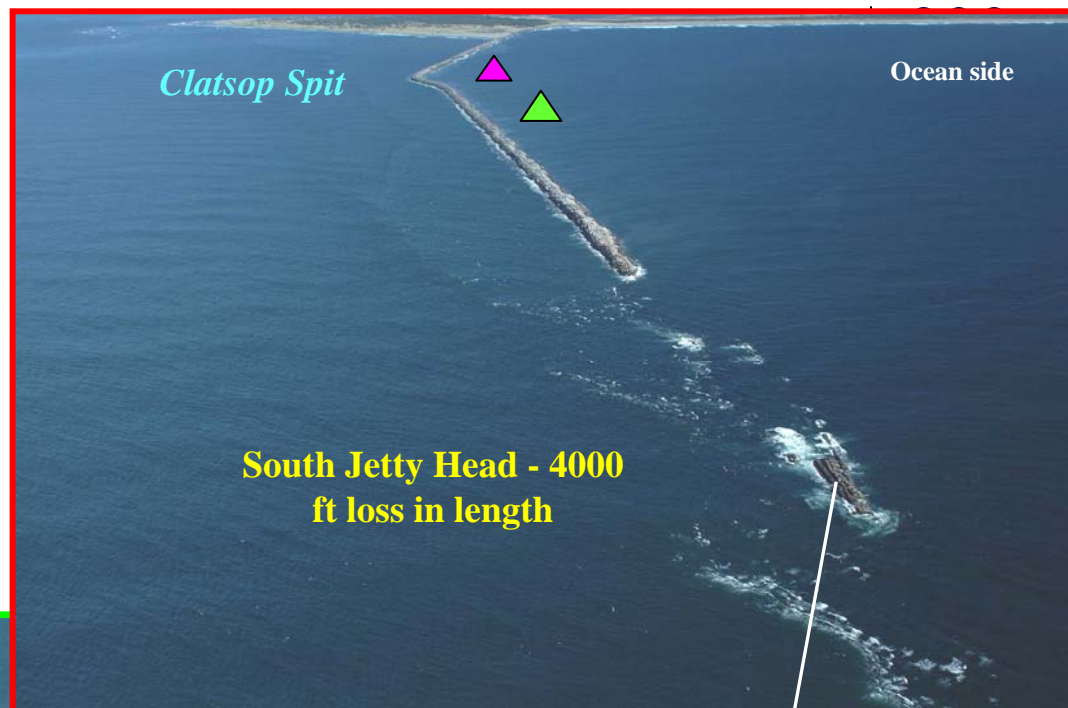
**Sediment Transport
through Breach
⇒ Severe Erosion**

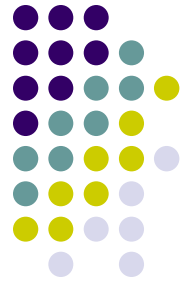
**Shoreline
before Breach**

**Storm Surge and
Wave Runup at
Runnel**

**Wave
Overtopping at
Weakened Jetty
Root**







Structure Inspections & Monitoring

- What are we trying to do at Base Level?
 - Identify initiation of damage.
 - Assess seriousness and rate of damage.
 - Assess functional impacts of no-action.
 - Provide budget and consequence info to decision-makers at higher levels.

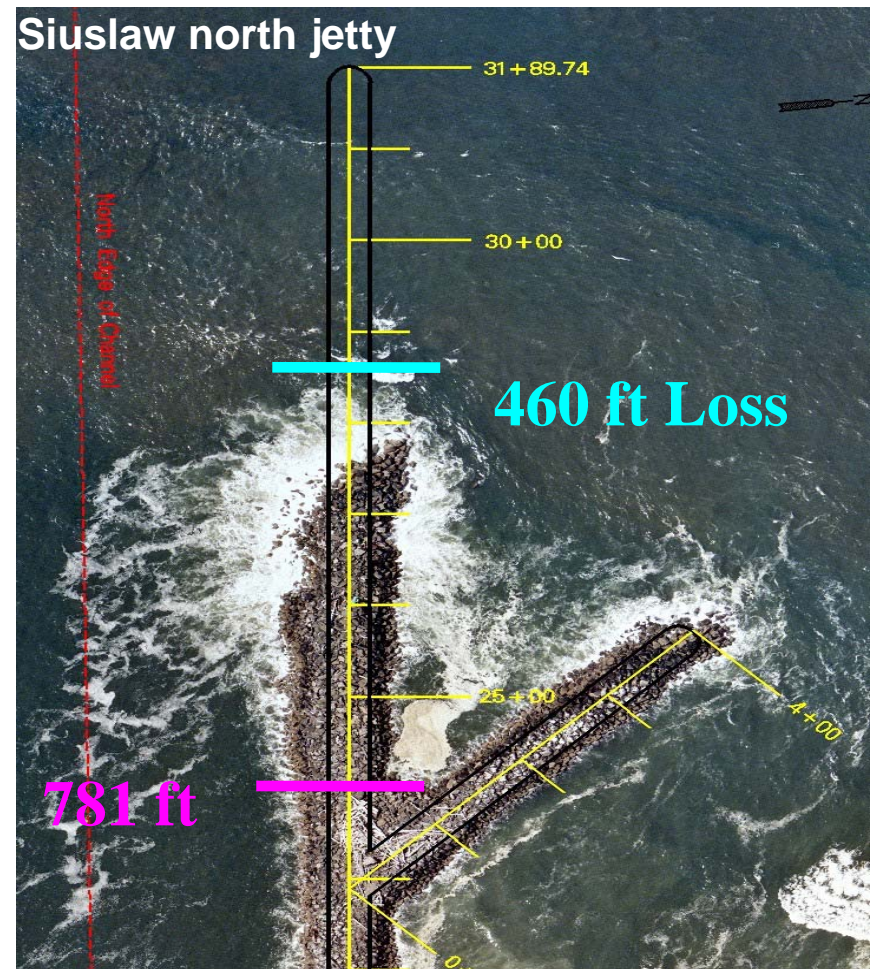
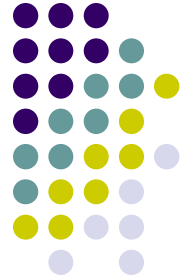
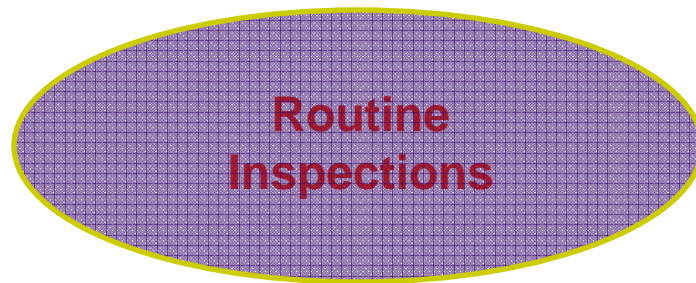


Fig. Present & projected (2010) head positions



Structure Inspections & Monitoring

- **Two-Tiered Approach**



1. Annual - \$55 to \$100 K
2. Yearly Inspection Report
3. Updated Coastal Projects Matrix
4. Budget and Project Recommendations



1. Conducted as identified by Routine Inspections
2. Structure and Hydrographic Surveys (\$120 k)
3. Engineering Assessment (\$10 to \$30 k)
4. Budget and Project Recommendations



Tier details

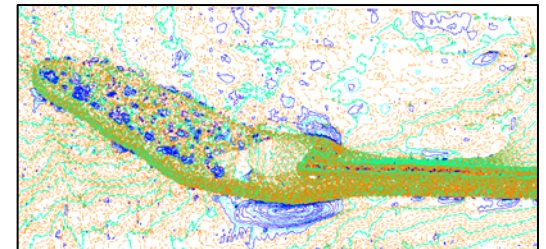
- **Routine Inspections**

- Field Inspections of Projects (GPS)
- Aerial and Oblique Photographs
- Port and Coast Guard Questionnaire



- **Evaluation Study**

- Surveys - Photogrammetric and Multi-beam
- DTM of Structures & Comparison to template
- Project History – Construction, Channel, Shoals, Shoreline
- Identification of Changes in Environment since Construction
- Projection of No-Action & Functional Impacts
- Projection of Repair Costs





Routine Inspections - products

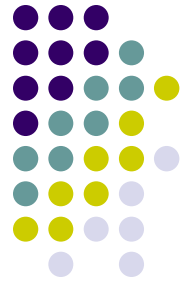


Fig 1. Identify coordinates of jetty head and damage areas with handheld GPS



Fig 2. Target/control points for aerial photography

MCR North Jetty (6/05 Inspection)	
GPS Pts.	Description
TREE	Tree located on north side of crest near shoreline
HOLE	Large hole in sideslope on ocean side
S15	channel side scallop
S14	channel side scallop
S13	channel side scallop
S12	channel side scallop
S11	channel side scallop
S10	large scallop on both sides (worst section outside of 2004 interim repairs)
S9	channel side scallop
S8	channel side scallop
S7	channel side scallop
S6	channel side scallop
S5	channel side scallop
S4	channel side scallop
S3	channel side scallop
S2	ocean side scallop
S1	channel side scallop
HEAD2005	jetty head



Routine Inspections

- Inspections must be conducted by **experienced coastal engineers**
- Due to **funding and personnel restrictions**, inspection and reporting efforts must be **streamlined**
- **Product of inspection must be relevant** to the engineering assessment and the budget process
- Routine Inspection or Base Level of Inspection **cannot** provide the following key elements:
 - **Seriousness of damage**
 - **Functional impacts of no-action**
 - **Budget and consequence info**
- Next level which **quantifies and places within historical and project framework** is needed. (Evaluation Study)



Evaluation study

<u>Design Parameter</u>	<u>1966</u>	<u>1978</u>	<u>1988</u>	<u>2001</u>
Wave Height (ft)				
Above 0 ft m.l.l.w.	21.8	20.2	28.0	33.0
Below 0 ft m.l.l.w.	21.8	20.2	22.0	31.0
Water Level (ft, m.l.l.w.)	+10	+8	+10	+13
Stability Coefficient				
Above 0 ft m.l.l.w.	7.1	8.1	7.1	8.0
Below 0 ft m.l.l.w.	7.1	8.1	4.6	4.0
Stone Density (pcf)				
Main Body	167	167	167	165
Toe Berm				178
Structure Sideslope (V:H)				
Above 0 ft m.l.l.w.	1:2	1:2	1:2	1:2.5
Below 0 ft m.l.l.w.	1:1.5	1:1.5	1:1.5	1:4.0
Crest Elevation (ft, MLLW)	+20	+20	+20	+20
Crest Width (ft)	30	30	30	40
Armor Stone Size (tons)				
Main Body	22.0	18.9	31.1	38.0
Toe Berm	22.0	18.9	31.1	29.0

MCR

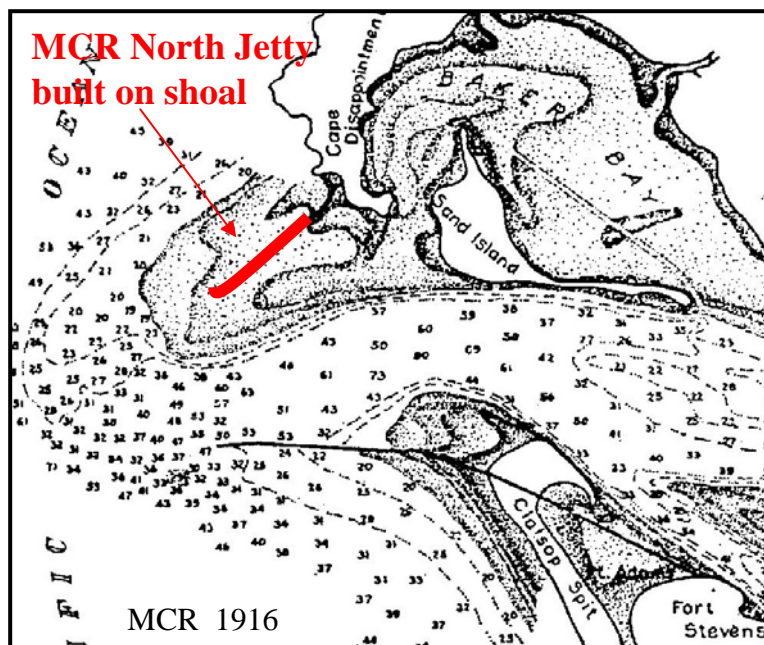
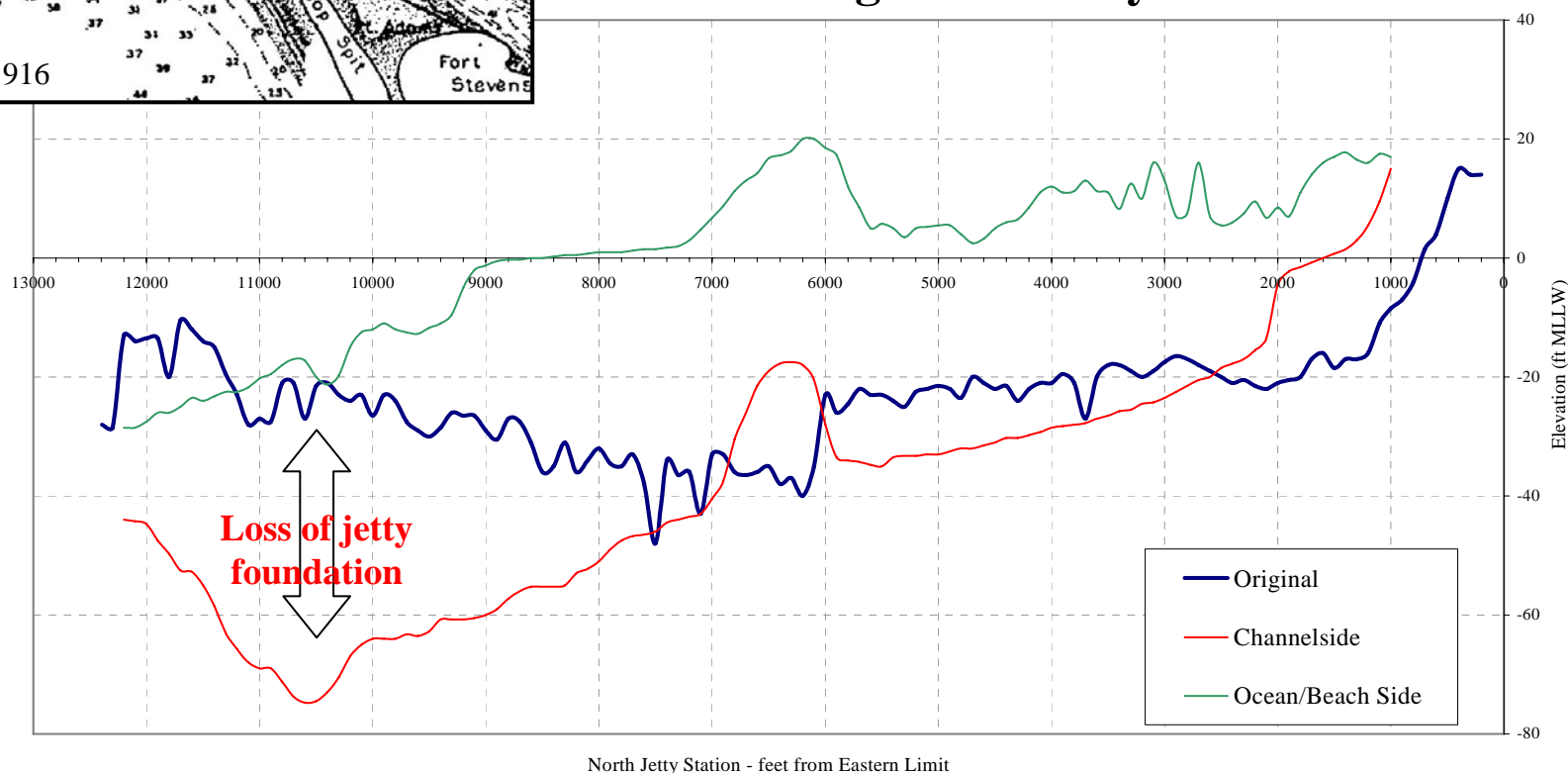


Fig. Most of the jetties were built on shoals, as the shoals erode, the jetty foundations become affected. This loss of foundation causes slope failure and increased wave impact leading to jetty erosion both at the jetty ends and trunks.

Profile along North Jetty Toe



Evaluation study - Products

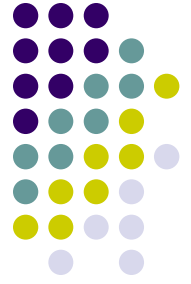
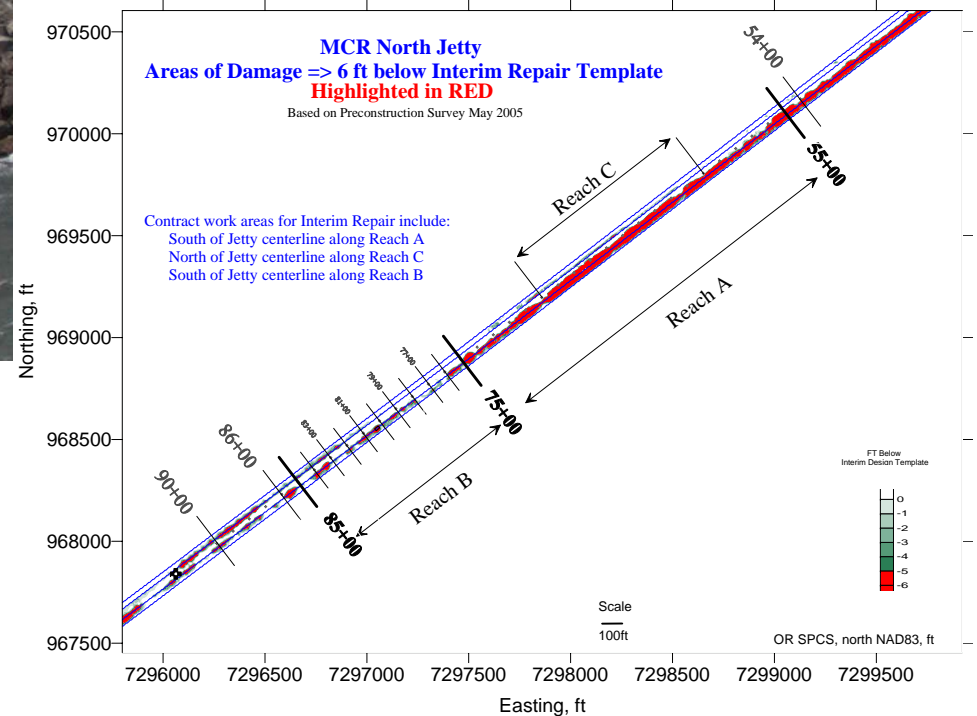
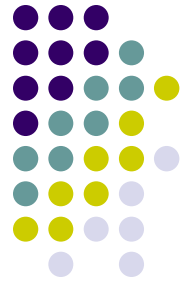


Fig 1. Oblique photography linked to survey

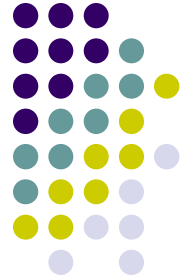
Fig 2. Photogrammetric & Hydro surveys





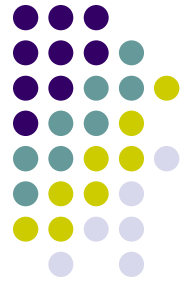
Reporting Tools

- **Yearly Inspection Reports**
- **Evaluation Study Conclusions**
- **Coastal Projects Matrix** (Summary info)
- **5-Year O&M Plan** (Budget info)
- **Photographs** – Ground, Aerial, Oblique, Historical
 - These often provide the best communication for damage trends as well as functional impact.
- **Economic and Usage Ranking of Projects**
 - Provides prioritization and ranking information to decision-makers.



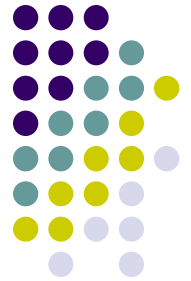
Coastal Projects Matrix

- **Project History**
 - Construction date and length
 - Last maintenance date and location
- **Structure Condition/Damage Area**
 - Head, Trunk, Root Condition
 - Length lost from Head
- **Navigation Use**
 - Commercial, Recreational, Charter Vessel Usage
 - Coast Guard Presence
- **Level of Concern**
 - Chance of Structural Failure
 - Chance of Functional Failure
 - Navigation Concerns
 - Degree of Urgency Ranking



5-Year O&M Plan

- **Monitoring:** Routine monitoring to assess structural and functional performance of project
- **Data Collection:** Structural and hydrographic survey data collection to identify degree of problem.
- **Evaluation Study and/or Modeling:** Preliminary study to assess functional impacts of problem and budget needs.
- **MMR or MRR:** Design report which quantifies degree and extent of repair and recommended plan.
- **P&S:** Document which leads into repair construction.
- **Interim Repair Construction:** An out-of-cycle repair that requires an accelerated track due to potential impacts.
- **Construction:** Planned for repair construction.



Challenges

- Funding for Inspections and Surveys
- Analytical Tools to Quantify No-Action Impacts
- Effective Reporting and Communication Tools
- Funding Maintenance Program rather than by Project
- Funding for Repairs:
 - Preventative Maintenance (\$.5 to \$5 M)
 - Incremental Repairs (\$5 to \$20 M)
 - Rehabilitation Repairs (\$20 to \$150 M)
- Small Ports not Funded for Inspection/Maintenance
 - *What is our responsibility to these existing projects?*
- Political Interest = Money to Inspect/Maintain